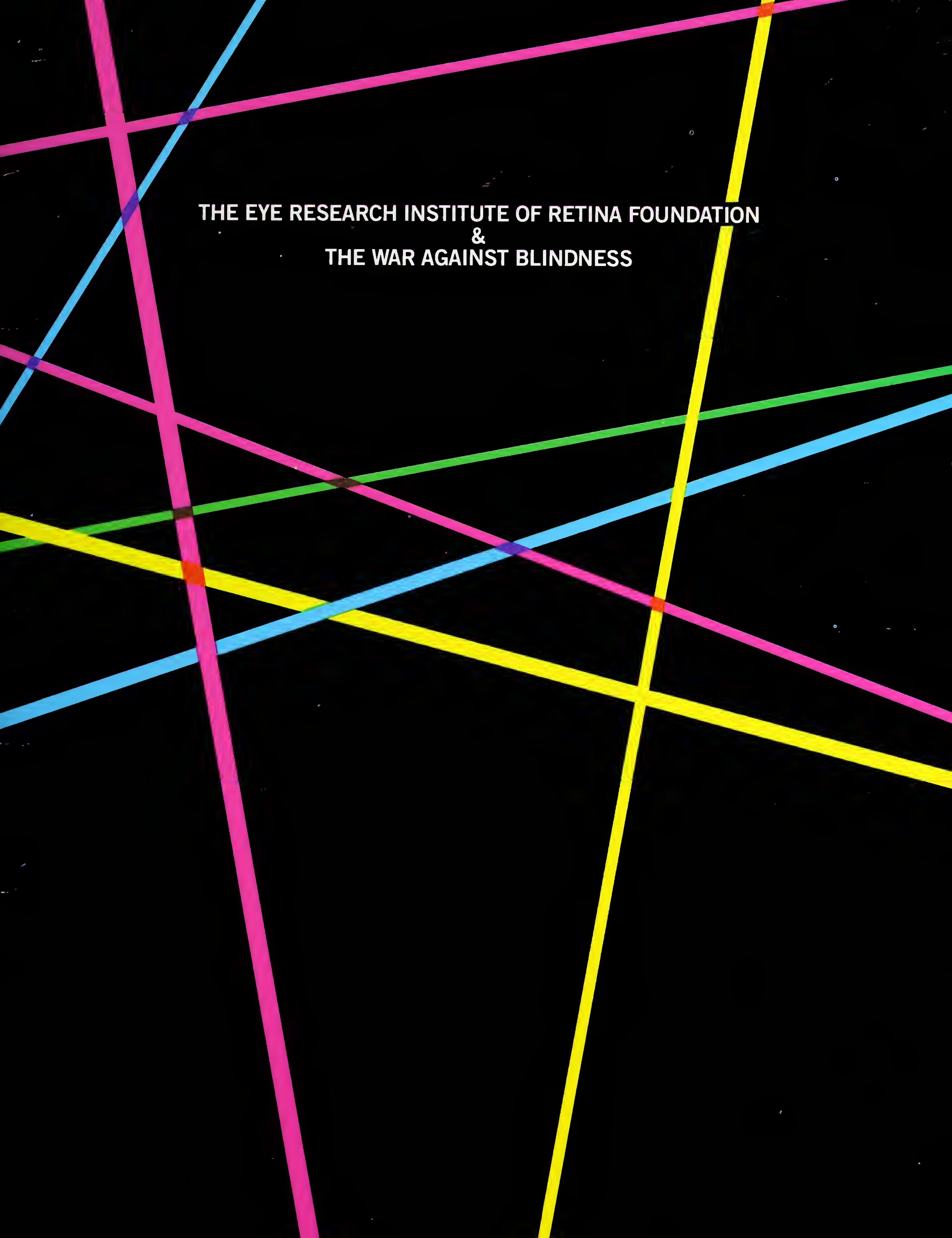


THE EYE RESEARCH INSTITUTE OF RETINA FOUNDATION
&
THE WAR AGAINST BLINDNESS

ABOUT OUR COVER:

Designer/Illustrator, Thomas Shoemaker, has created a cover design depicting the beams of laser light that have become such a useful tool in the battle against blindness.

The Argon Laser (green & blue)

Presently most useful in eye treatment.

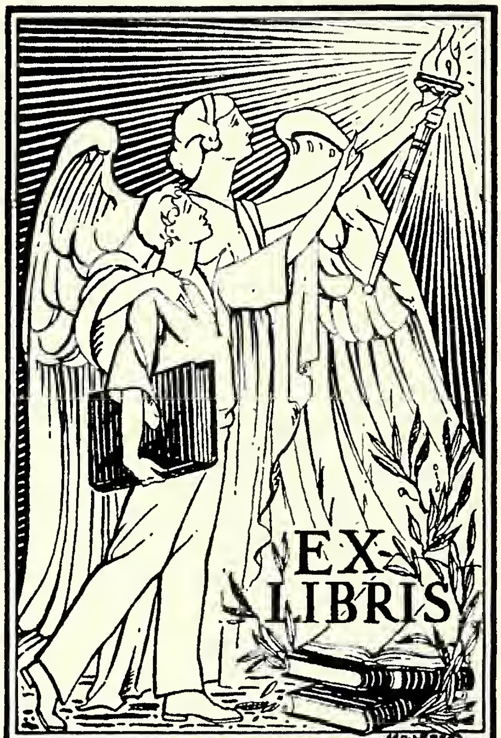
The Krypton Laser (yellow)

Hope of the future in eye treatment.

The Helium-neon Laser (red)

Used in diagnosis of eye problems.

Lasers are important weapons in the war against blindness. Scientists and clinicians of the Eye Research Institute have been responsible for much of the development and refinement of lasers for use in diagnosis and treatment of eye diseases.



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THE EYE RESEARCH INSTITUTE OF RETINA FOUNDATION
&
THE WAR AGAINST BLINDNESS

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FOREWORD

From the chronicles of the Old Testament, through Homer, Sophocles, Shakespeare to our own times, great dramatists, poets, and novelists depict the loss of sight as the most horrendous and pitiful fate that can befall a human being. Indeed blindness is referred to frequently as "a fate worse than death."

Our personal attitudes toward blindness are extremely complex, rooted as they are not only in a substantial body of religious and classic literature, but in myth, folklore, and other aspects of our cultural heritage.

Until recent times, the United States had a relatively low incidence of blindness. "Going blind" was considered incurable and the inevitable toll of old age. When blindness did strike someone we knew, our attitude was curiously passive compared to our outrage toward "killing" diseases. As a nation we can no longer afford this attitude. Blindness and severe visual impairment, often curable and preventable, affect an increasing segment of our population.

Within a generation, if nothing more is done than at present, there will be few families in the United States that will not have to deal with the tragedy of blindness. Among the young – among the aging.

As we have waged war with increasing success on other diseases through medical research, we must wage war on blinding eye diseases.

At the Eye Research Institute of Retina Foundation, we have been waging this war for over a quarter of a century. We have had many victories but the greatest battles lie before us.

"The Light of the Body is the Eye."
Mathew VI 22

"...for thou wert better dead than living and blind"
Sophocles, Oedipus Rex

"...for which all the discomforts that will accompany my being blind the good God prepare me."
Samuel Pepys, Diaries, Last Entry

"The case for the elimination of unnecessary blindness is justified not only on humanitarian grounds but also by its social and economic consequences. In terms of economic loss, blindness is the most expensive of all causes of serious disablement."
The World Health Organization, Geneva, 1972.

"Loss of sight is a dying."
Father Thomas J. Carroll.

THE EYE: ANTENNA OF THE BRAIN, WINDOW OF THE BODY

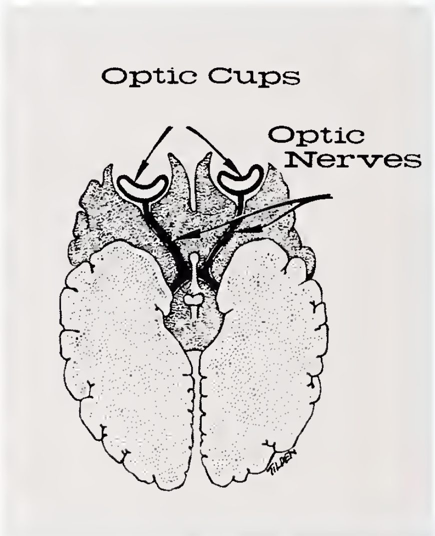
The human eye is approximately one inch in diameter. Through it we take in over ninety per cent of the information that forms our perception and understanding of the world around us. The eye is the most complex organ of the body, save only the brain itself. The eye is, in fact, an extension of the brain. Lining the interior of the eye, is thin tissue called the retina. The retina is brain tissue, and is formed along with the optic nerve and the brain itself in the very earliest stages of human development. Light rays are captured on the retina and translated into signals to other parts of the brain where the miraculous event we call "vision" takes place.

Advances in scientific technology now allow our investigators, while studying the eye, to study through it the function of the living brain without invading the body. Similarly, scientists can observe through the eye the function of other body systems, including the vascular system, and record the changes that take place between health and sickness, between youth and old age. At the Eye Research Institute the eye is more in truth than poetry: "the window of the body".

Early development of the eye.

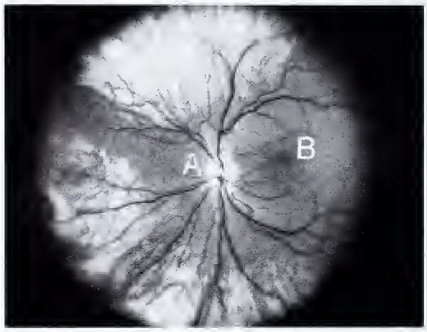
When the brain develops in embryo, it almost immediately forms two branches (the optic nerves) which end in two little cups (the retina). The eye is truly the antenna of the brain; each optic nerve contains one million fibers entering the brain from the eye.

Research techniques are presently available to study how vision occurs.



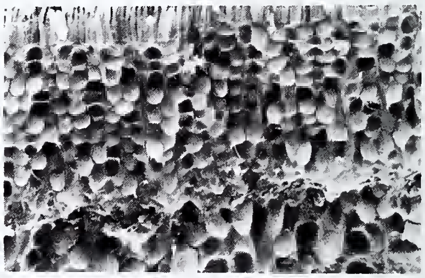
The retina.

The accompanying photograph of the interior of the eye is taken through the Institute's new Equator-Plus wide angle camera. The optic nerve connects with the retina at point "A". This is the optic disc and is the so called blind spot of the eye. The dark area at "B" is the intense concentration of light-sensitive photoreceptors, called the macula. 85 per cent of all retinal receptors are concentrated in the macula. It is the macula that gives us our detailed vision and perception of color. The retinal tissue itself consists of eight separate layers of cells and is about the thickness and consistency of a sheet of wet cigarette paper.



The photoreceptor cells.

The light-sensitive cells of the retina, called the "rods" and "cones", are shown below magnified approximately 30,000 times in a scanning electron microscope photograph. These receptor cells convert incoming light waves to a system of electrochemical impulses that travel through the optic nerve to the visual cortex of the brain to produce vision.

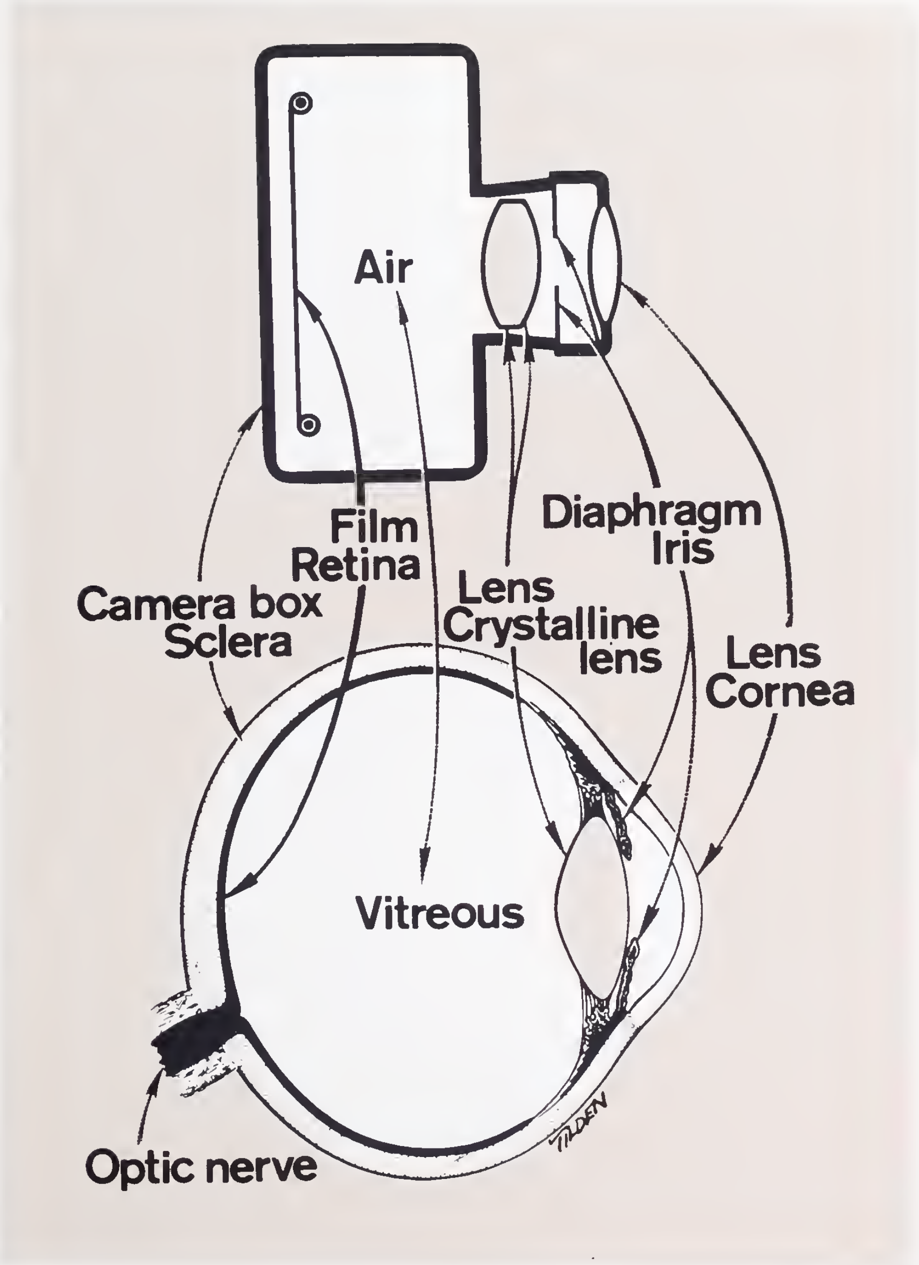


micrograph: Dr. Bruce Szamier

One of the most fascinating aspects of the retina is that it performs certain discriminating, or decision-making, processes among its cells as does the brain itself.

The eye as a camera

The processes of vision that take place within the eye itself are similar in many ways to the operations of a camera, in which lenses focus the picture on a sensitive film. In the human eye, the cornea (transparent tissue resembling a watch crystal) and the crystalline lens focus images on the retina, which is a thin, light-sensitive film at the back of the eye. The picture, which is registered in the retina, is transmitted to the brain by the optic nerve, which is a one million conductor "telephone cable" How the picture is transmitted and how it becomes "seen", is not yet understood. The iris of the eye performs a function similar to that of the diaphragm of a camera – expanding or contracting the pupil in response to the amount of light available. The crystalline lens of the eye, unlike the rigid glass lens of the camera, is flexible and is instantly adjusted to focus on near or distant objects by muscular action. The space between lens and retina is filled with a transparent jelly called the vitreous body. The sclera (the white of the eye) is comparable to the box which holds lens and film in place.



BLINDING EYE DISEASE: A GROWING THREAT FROM AN ANCIENT ENEMY

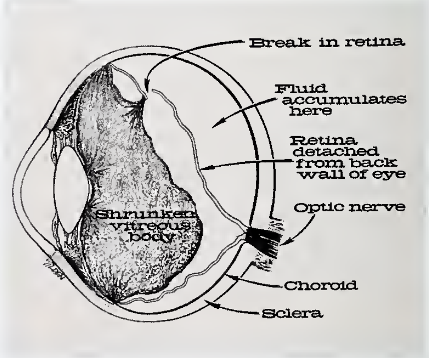
The earliest existing record of medical interest in blinding eye disease is believed to be found in the Ebers Papyrus (about 1500 B.C.) which devotes an entire chapter to the subject. We learn from the Greek historian Herodotus that in Egypt during the fifth century B.C., there were physicians specializing in diseases of the eye. The ancient physicians, among them Hippocrates and Galen, devoted much of their writing to blinding eye diseases. Yet for all the centuries that have gone by, for all the innate fear mankind has of blindness, for all the remarkable advances in modern medicine, we still know distressingly little about the eye, about vision, and about the fundamental causes of blindness. This is especially true in comparison to our knowledge of other organs, their functions and their diseases. In the United States, the dramatic increase in the incidence of blinding eye disease is paradoxically the result of our success in other branches of medical science. As research has extended the human life span and helped both young and old survive once fatal ailments, it has unwittingly increased the chances that millions will spend much of their lives without useful vision. There is, however, a hopeful aspect to this grim situation. While eye research has long been a stepchild of medical research recent advances in other branches of science and technology have created an enormous and powerful arsenal that, with the support of an awakened public, can be drawn on by the Institute to produce tangible benefits in the foreseeable future.

SOME MAJOR CAUSES OF BLINDNESS

Diseases of the retina and vitreous

Diseases of the retina and vitreous are the leading cause of blindness in this country.

The delicate, light-sensitive retinal tissue of the eye is subject to a considerable number of disorders leading to blindness or severe visual impairment. The retina can become detached from the adjacent tissue that carries its blood supply through injury, or through hereditary, congenital, or circulatory disease (see illustration). It can be adversely affected by damage or disease of the vitreous. Two degenerative diseases of the retina are taking an increasing toll in blindness among the young (retinitis pigmentosa) and the aging (macular degeneration). Diabetic retinopathy, the principal cause of new blindness in Americans, is a disease attacking the retinas of long-term diabetics. It is characterized principally by hemorrhaging and the proliferation of unhealthy blood vessels into the vitreous. While surgical procedures have been developed to preserve the sight of victims of many retinal and vitreous diseases, the causes of these diseases, which affect over a million and a half people, are largely unknown.



FRIGHTENING FACTS

Corneal Diseases

Throughout the world, diseases of the cornea are probably the leading cause of blindness. In many instances both the cause and cure of the diseases are unknown to medicine. In the United States, damage to the cornea by disease and physical injury is a major cause of blindness. There are 300,000 cases annually of corneal scarring caused by the Herpes Simplex virus that can lead to blindness.

Glaucoma

Glaucoma is characterized by the build up of excessive pressure within the eye which destroys vision. The most common form of glaucoma, which affects over two million Americans, is also the most insidious. Visual loss occurs slowly, painlessly, and is irreversible. Most cases of glaucoma can be controlled by medication; other forms must be treated surgically. The fundamental cause of glaucoma remains unknown.

Cataract

The word "cataract" describes a clouding or opacity of the normally clear crystalline lens of the eye. While the classic operation for the removal of cataract is one of the safest surgical procedures known, the great number (400,000) of cataract operations performed in the United States annually represents an enormous cost to the American people. In under-developed countries of the world, the number of people totally blind from operable bilateral cataract is estimated at 17 million. Unable to work, most of these victims are doomed to slow death from starvation.

- *No one really knows how many blind Americans there are. Official census records show there are over 500,000 legally blind.*

- *In addition there are over 1,500,000 Americans functionally blind. This means they cannot see to read this message, even with glasses. Whether one is legally or functionally blind, the difficulties in economic survival and living a useful and pleasurable life are considerable.*

- *More Americans are going blind than ever before: Older Americans who are living longer because of advances in medicine, younger Americans with genetic tendencies to blindness producing diseases, who might not have been born or would not have survived thirty years ago.*

- *The largest single cause of new blindness in America is diabetes. While new methods of treatment for diabetic retinopathy offer hope for some, the number of (long term) diabetic blind could reach 500,000 within the next generation. That's equal to the total number of U.S. people legally blind today!*

- *Among our rapidly increasing population of older citizens, the problem of blindness and severe visual impairment is particularly oppressive. Three out of four of the reported 670,000 cases of macular degeneration are among people over 65. However, in healthy people over 50, increasing numbers are losing their ability to read, recognize faces, colors, drive a car, or do useful work because of macular disease. An overwhelming majority of cases of retinal detachment, cataract, and glaucoma occur in older people.*

- *Visual problems are on the increase among children – about 56 million children today. It is estimated that this figure will increase to 75 million by 1980.*

- *500,000 major eye operations are performed annually. The cost is staggering. The annual cost of cataract surgery alone is over $500,000,000.*

- *The direct cost of blindness and severe visual impairment is conservatively estimated at 7 billion dollars. Annually! This does not include the indirect burdens to the economy of loss of productivity and wage earning, loss of tax revenue, cost of insurance, government assistance, rehabilitation, etc. These costs approach three billion dollars annually.*

- *Accidents account for only 3% of all cases of blindness. The underlying causes of most eye diseases are still unknown.*

- *For every dollar that blindness costs our society, only one cent is spent in research to prevent blindness.*

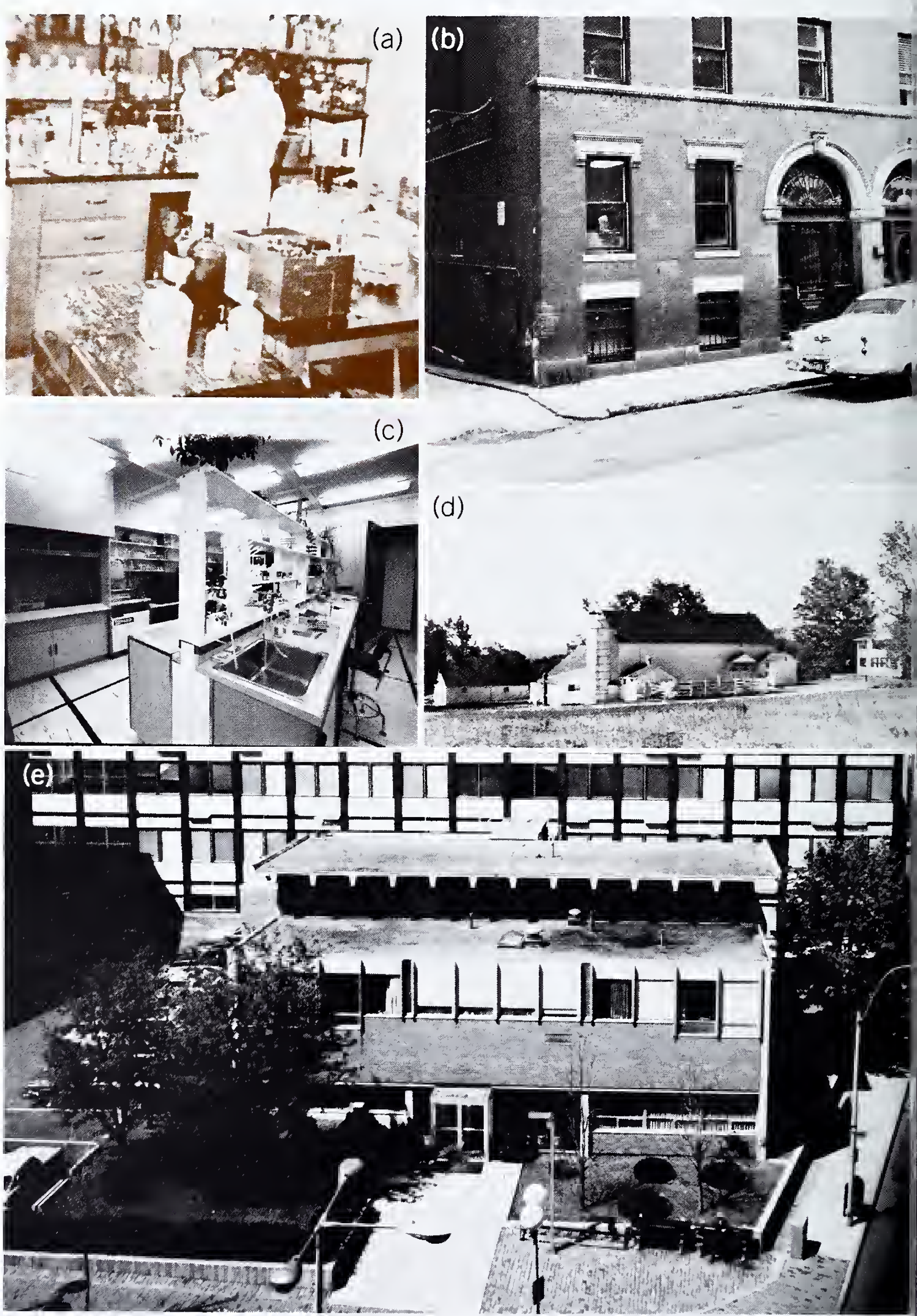
INDEPENDENT, AGGRESSIVE, PRODUCTIVE...THE EYE RESEARCH INSTITUTE OF RETINA FOUNDATION IS UNIQUELY PREPARED TO ACHIEVE NEW VICTORIES OVER EYE DISEASE.

Founded in 1950 by Dr. Charles L. Schepens, the Eye Research Institute of Retina Foundation has grown from quarters in a single room of a Boston tenement to a modern three-story $6 million laboratory devoted exclusively to eye research. It is considered to be the largest independent and most productive organization of its kind in the world.

Many of the most widely used instruments and techniques in the diagnosis and treatment of eye disease have been initiated or perfected by scientific investigators and clinical associates of the Eye Research Institute. These achievements have been used by ophthalmologists all over the world to treat such blinding eye conditions as retinal detachment, diabetic retinopathy, glaucoma and various diseases and problems of the cornea.

As an independent organization, the Institute is unique in its total concentration on research. It is not burdened by patient care and teaching responsibilities typical of other institutions carrying out eye research. Human studies and clinical trials are performed by clinical associates of the Institute at such outstanding patient facilities as the famed Retina Associates, Massachusetts Eye and Ear Infirmary, Tufts New England Medical Center and other distinguished medical facilities here and abroad.

The Institute's success can be measured by the tens of thousands of people for whom vision is restored or preserved annually through the techniques and treatments developed by its scientists and physicians.



First laboratory (a) and original tenement home (b) of the Institute. (c) Physical chemistry laboratory typical of present modern facilities. (d) The Institute's 100 acre farm and animal facility in Townsend, Massachusetts. (e) Administration (foreground) and laboratory buildings or Staniford Street, Boston.

ABOUT DR. SCHEPENS...

Born in Belgium in 1912, Dr. Charles L. Schepens studied mathematics before switching to medicine. He received his medical degree in Belgium in 1935. After graduate research work, he trained in eye diseases at Moorfields Eye Hospital in London.

When Belgium was invaded in 1940, he was a medical officer in the Belgian Air Force. With the fall of his country, he established a distinguished war record as a leader of the underground movement. Discovered by the Gestapo, he was forced to flee to France, where he continued underground work under the name Monsieur Perot. He became a legendary figure in Southwestern France, where he enlisted the help of shepherds in smuggling documents and guiding escapers across the Pyrenees into Spain. Perot was finally arrested, but he escaped again and made his way to England.

When Dr. Schepens arrived in England, he resumed his ophthalmological career at Moorfields. Using his skill in mathematics and engineering, he developed a technique of examination of the inside of the eye called binocular indirect ophthalmoscopy. The method and instrumentation, later perfected at the Eye Research Institute, is the most important technique used today in the diagnosis of retinal diseases.

Dr. Schepens came to the United States in 1947 as a fellow in ophthalmic research at the Howe Laboratory of Ophthalmology, Harvard Medical School. He became the first Director of the Retina Service at the Massachusetts Eye and Ear Infirmary in 1949 and in 1950 he established Retina Foundation.

Dr. Schepens has been called "the father of modern retinal surgery" and throughout the years has received numerous awards for his outstanding accomplishments.

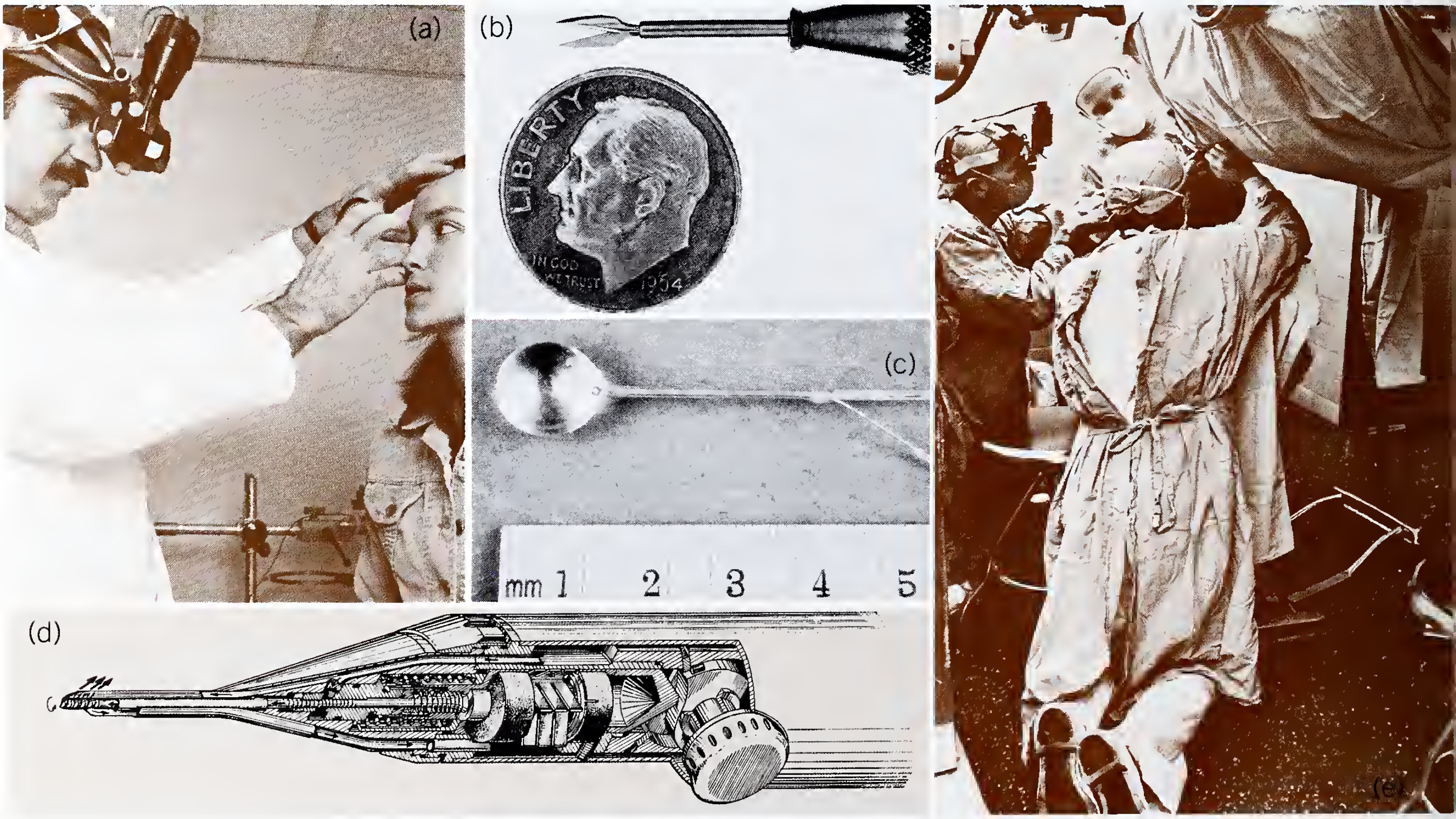
Emerson describes an Institution as "the lengthened shadow of a man". This is indeed true of the Eye Research Institute which Dr. Schepens founded and guides as President. It is reflected in the unique balance of research programs between the "practical" project which may help an eye surgeon to preserve a patient's sight "tomorrow", and the visionary programs of fundamental research which will, hopefully, give patients even greater benefits in years to come.

ACHIEVEMENTS OF THE EYE RESEARCH INSTITUTE OF RETINA FOUNDATION

Major medical advances are invariably built upon years of painstaking effort. Many programs of the Institute initiated ten years ago or more are only now reaching the levels of medical application for which they were conceived.

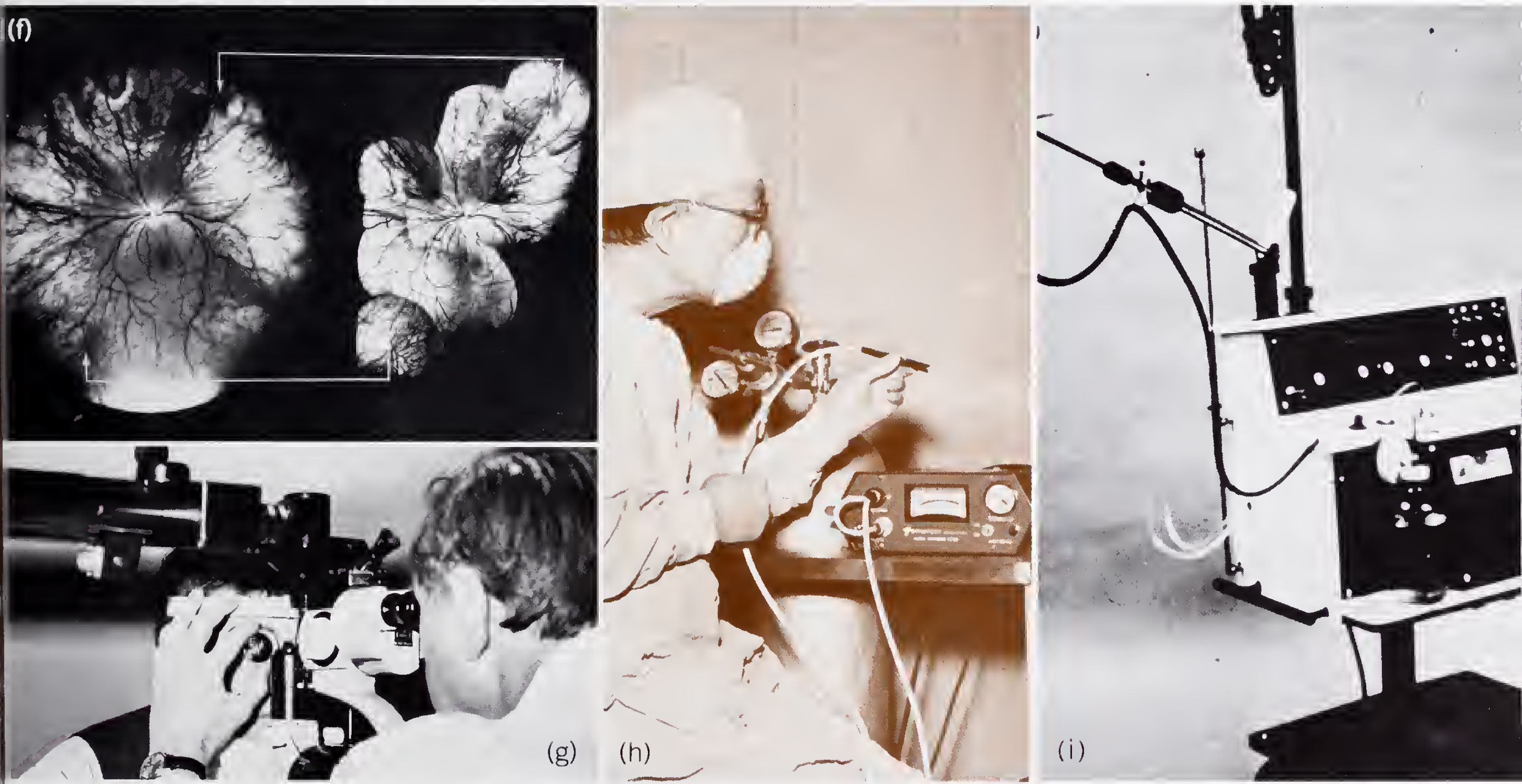
Through research, the Institute has made a considerable number of contributions that have improved our understanding and management of blinding eye diseases. Among them are:

- The Schepens indirect binocular ophthalmoscope. This instrument is considered by many to be one of the greatest single technological advances in ophthalmology in modern times. Its use made possible far more thorough diagnosis and treatment of diseases of the retina than ever before.
- New surgical methods and materials developed by joint efforts of Institute laboratories and clinicians have increased the rate of success in the surgical treatment of retinal detachment from 40% to over 90%.
- Much of the scientific knowledge of the chemical and physical characteristics of the vitreous body has been generated at the Institute. The most promising known substitute for the vitreous was developed at the Institute.
- The Institute has pioneered in the development of the surgical procedures and the sophisticated instrumentation that now makes vitreous surgery possible and increasingly effective.
- The application and refinement of the laser as a precise, non-invasive surgical tool in the treatment of eye diseases, such as retinal detachment and diabetic retinopathy, is a major accomplishment of the Institute.



(a) Eye doctors throughout the world use the Schepens Indirect Binocular Ophthalmoscope to examine the retina. Pioneering micro-instruments developed at the Institute include: (b) tiny vitreous scissors; (c) inflatable intraocular "balloon" to manipulate retinal adhesions; (d) instrument to remove cataracts through a tiny incision; (e) upside-down operating table designed and built at the Institute, uses gravity to assist surgical reattachment of giant retinal tears.

- One of the most common causes of corneal blindness is the invasion of the eye by Herpes Simplex virus. Institute Laboratories have demonstrated the safety and efficacy of a new anti-viral drug, Vidarabine (Vira-A or ARA-A), which has just been released for professional use. The clinical development of this drug may also have great importance in the treatment of other Herpes problems.
- The achievements of the Institute's Polymer Chemistry Laboratory are recognized internationally and include a plastic button to replace the cornea in desperate cases; special adhesives to seal corneal wounds; therapeutic contact lenses to protect diseased corneas and enhance healing, and many other materials used in retinal surgery.
- An important step in the treatment of corneal ulceration (the "melting" of corneal tissue) is the identification of both the enzyme that causes the problem and the inhibiting factor which will arrest its activity.
- The Optical Physics Laboratory of the Institute has recently introduced the Equator-Plus Fundus camera which in one photograph can show overall details of the interior of the eye that heretofore would have taken between thirty and eighty photographs to accomplish.



(f) One wide-angle fundus photograph by new Equator-Plus camera takes place of thirty to eighty photographs for more accurate diagnosis, greater patient comfort; (g) treatment for diabetic retinopathy with argon laser developed at Institute; (h) CO_2 cryoprobe perfected at the Institute delivers ultra-cold temperatures for use in several important eye surgery procedures; (i) automated "nibbler" and console developed for vitreous surgery.

IN THE INSTITUTE'S MODERN LABORATORIES, BRILLIANT AND DEDICATED SCIENTISTS SEARCH FOR THE CAUSES OF EYE DISEASES

At the Eye Research Institute, over 160 scientists, physicians and supporting personnel have developed an unusual "mix" of research projects on the nature of vision and the causes of eye disease. This results in a stimulating interaction between laboratory scientists and staff clinicians.

"Applied research", draws on existing knowledge to develop new applications, such as new uses of the laser.

"Basic research" probes into unknown areas to acquire new knowledge that is the necessary underpinning of any substantial medical progress.

"Clinical research" investigates problems pertaining to disease in patients themselves. It can be either applied or basic.

At the Institute, all three types of research are actively pursued.

SOME OF THE STUDIES IN PROGRESS AT THE INSTITUTE

1. Retinal Degenerations

In our visually oriented society, the growing magnitude of visual impairment from retinal degeneration must be of national concern. These diseases affect the young and the aging. They include retinitis pigmentosa (a hereditary atrophy of the retina resulting in night blindness, tunnel vision and eventual blindness), macular degeneration (gradual loss of the ability to see fine detail), and high myopia (relentlessly progressive nearsightedness). The Institute has intensified its studies of these diseases in the areas of biochemistry, diagnostic instrumentation, and circulatory studies.

2. A Coordinated Attack on Diseases of the Macula

Blindness due to macular disease is rising dramatically in this country because it affects the increasing population of Americans over 50 years of age. The disease is particularly tragic because it affects people who are otherwise in perfect health and deprives them of useful vision in what should be their most productive and enjoyable years.

Until recently, all types of macular diseases were considered an inevitable and irreversible part of the aging process. However, research at the Institute indicates that this need not be the case. Inspired by these findings, the Institute decided to embark on a coordinated multi-disciplined effort with the goals of developing more effective diagnostic techniques, increasing our basic understanding of the disease process, and ultimately developing effective treatment, cure or prevention methods.

This is a most exciting example of a massive "frontal attack" on a major problem. To be successful such an attack requires a superior, enthusiastic research staff with adequate and continuing financial support. With sufficient funds, the question at the Institute will not be, "Can we do something about macular disease?", but, "How soon?".

The program involves the redirection and reinforcement of several existing research projects and the addition of promising new lines of investigation.

3. Diabetic Retinopathy

Diabetic retinopathy continues to be the most frequent cause of new blindness and severe visual impairment. Our research, therefore, continues to develop and refine instrumentation for earlier diagnosis and better surgical procedure to help preserve useful vision among victims of this disease. Basic studies into the mechanisms of diabetes that affect the eye have been intensified in the hope that means, other than surgery, can be found to prevent loss of vision.

4. Vitreous Disease

Studies on the biochemical and physical composition of the vitreous body of the eye were begun at the Institute over 25 years ago. With the knowledge gained, Institute scientists and clinicians pioneered in the development of micro-instrumentation and techniques for vitreous surgery. Important progress is being made in the development of acceptable natural and artificial replacements for the vitreous body damaged by disease or physical injury. Further knowledge of the role of the vitreous in maintaining the health of the eye is being sought in a number of interrelated laboratory projects.

5. Corneal Disease

The cornea is the structure of the eye most exposed to physical injury and infection. A clear, transparent cornea is essential to good vision. Cornea research at the Institute includes studies of new treatment for corneal infection, work with surgical adhesives for cornea operations, artificial replacements for corneas so diseased that human transplants are unacceptable; therapeutic contact lenses for the protection of diseased, or damaged corneas; studies of the allergic reactions involved in the use of corrective contact lenses; studies to find ways to promote "clear" healing of corneal wounds without opaque scar tissue, means to prevent corneal ulcerations, and surgical techniques to relieve corneal swelling.

6. Important Progress Against Herpes

"Fever blisters," or "cold sores," are caused by a virus: Herpes Simplex. Few people know this virus is one of the most common causes of corneal blindness. Repeated herpes attacks in the cornea can cause its scarring. Ultimately, the cornea may become opaque and the only way to preserve vision is by transplanting the cornea. The anti-viral drug, that has been in use for a number of years, has severe limitations. The Herpes virus often develops resistance to the drug. Recently, the Institute has not only uncovered a new and more effective drug, as mentioned before, but continues its search for an even better medical treatment of the Herpes infection.

(a) Examining a tissue culture in a study of the abnormal blood vessels found in diabetic retinopathy. (b) Studying the results of new medical treatment for Herpes infection of the eye. (c) Continuing development of new, more effective and precise uses of the laser for surgery and diagnosis.

7. Tears and Blinking

We take tears for granted, but they are most complex and are of great importance to the health of the eye. The tears keep the exposed portion of our eye both clean and moist, and blinking of our eyelids maintains the front of the cornea polished like a mirror. "Dry Eye Syndrome" is a potentially blinding disorder that occurs when the tears are insufficient in quantity or quality, or when the eyelids do not properly function. Investigators at the Institute study this problem to find better ways of alleviating the "Dry Eye Syndrome".

8. Cataract

The clouding of the crystalline lens through age or disease is a common and costly cause of blindness. Basic research in several laboratories of the Institute may contribute to medical management of cataract formation. Research in micro-instrumentation as an alternative, lower cost method for surgical removal of cataract is also under way.

(a) Investigating the relationship of a common cold virus to a cancer of the eye that strikes infants and young children. (b) Testing how well a new contact lens material "breathes" in the Polymer Chemistry Unit.

(c) Laboratory equipment and prototype instruments for clinical use are often designed and built in the Institute's own instrument shop. (d) Omar, a Siberian tiger cub, arrives at the Institute for successful cataract surgery using new micro-instrument. (e) A new vitreous surgery instrument is tested under operating microscope. (f) Preparing for biochemical study of the retinas of chicken embryos to determine the role of glutamic acid in retinal function. (g) Technician prepares a surface-tension test tank for tear-film studies.

9. Three Approaches to Cancer of the Eye

One of the most important areas of eye research relates to cancer. We can observe and treat cancer in the eye at a far earlier stage than in other areas of the body. This gives us a chance to test certain therapies that cannot be tested elsewhere. At the Institute we are currently engaged in three important studies – each of which may have far reaching significance in the understanding and treatment of cancer elsewhere in the body.

In 1969, the Institute joined other Boston medical institutions in petitioning the government to preserve the cyclotron installation at the Harvard High Energy Physics Laboratory. This cyclotron was, and is, the only apparatus of its kind with a potential for medical use. After many years of study, Institute physicians are using the cyclotron's Proton beam to treat patients with a malignant tumor of the choroid. In the past this condition frequently called for removal of the eye, and even after such a drastic procedure, often the patient did not have a prolonged survival. Results to date of Proton therapy have been most encouraging.

Another cancer research project deals with retinoblastoma – a tumor which strikes infants and very young children, and often runs in families. Our scientists have demonstrated that a similar cancer can be produced experimentally in the laboratory. In another step toward conquering this form of cancer, scientists have shown that this disease can be transplanted from one animal to another.

A joint effort of the Institute's microsurgery and polymer chemistry laboratories has been directed toward the delivery of anti-cancer drugs directly to the site of an eye tumor. In this program, a small plastic "balloon" is implanted surgically next to the cancer and releases the anti-cancer agent at a predetermined rate. This system, if it proves practical, may eliminate the very severe side effects that are caused by the heavy dosage of drugs that must be injected into the patient's blood stream during cancer chemotherapy.

10. New Optical and Electronic Apparatus

Radically new instruments are being developed to measure the effect of circulatory deficiency on vision; New laser machines are being tried to treat certain retinal diseases more safely and effectively; Instrumentation invented by NASA for tracking satellites is now being harnessed to study the eye in a number of different ways.

11. Mechanism of Vision

Basic studies to improve our understanding of how vision occurs are actively pursued in a number of closely related programs. This research involves the development of ultra-sensitive techniques to detect the events that are triggered by exposure of the retina to light. Such techniques require the most modern electronic equipment and the analysis of chemicals in microscopic amounts.

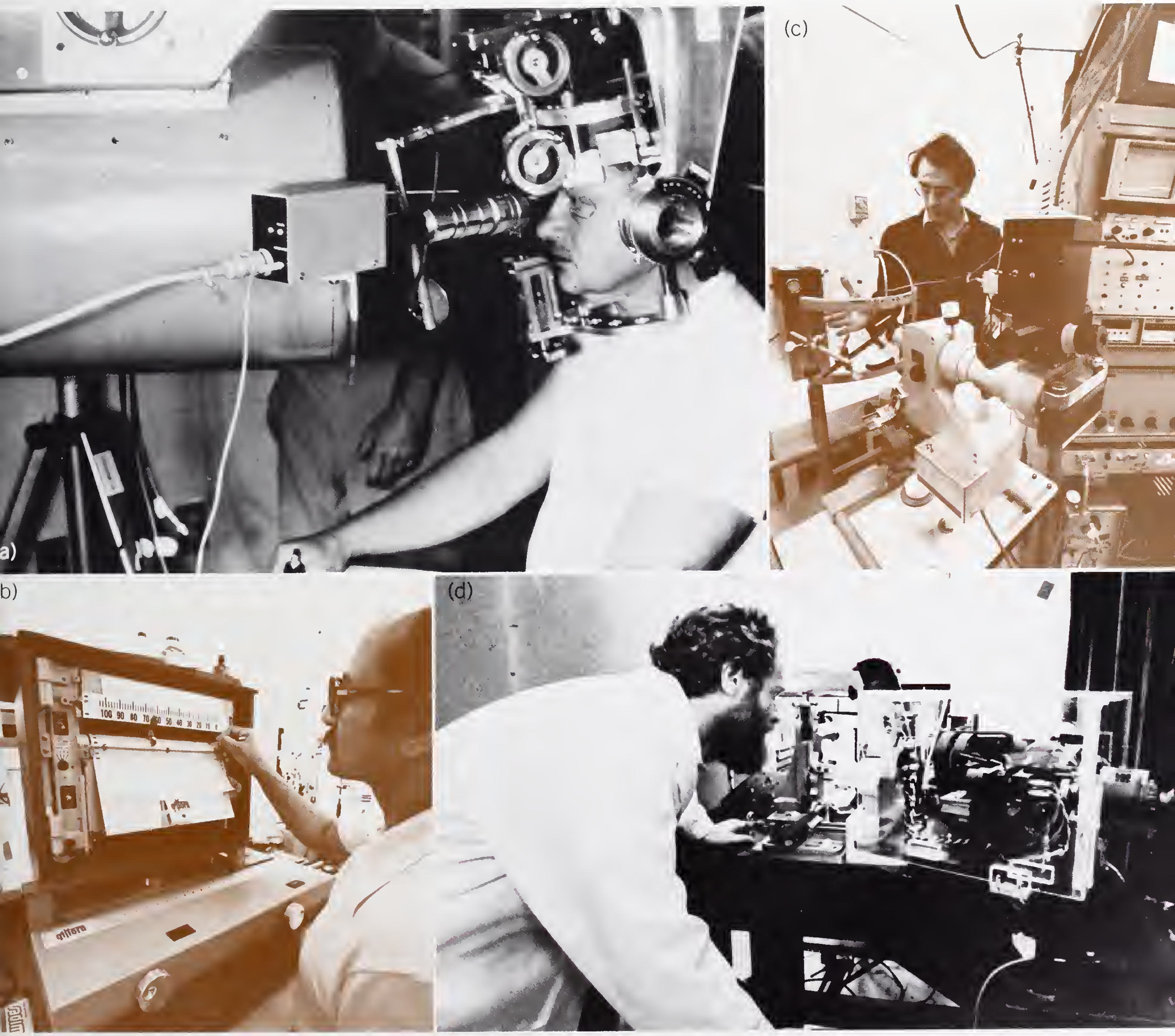
Basic Research into Important Tissues of the Eye

The eye is an extremely active organ with very high energy requirements. But, because the fundamental structures of the eye (the cornea, the lens, the vitreous, the retina) are transparent, nature has had to find a way to deliver nutrition with a minimum of blood vessels. The circulatory system of the eye is, therefore, very delicate and highly specialized. Unfortunately, when the body is affected by such diseases as diabetes, or when we grow older, changes take place in the body's vascular system, which have a marked and often disastrous effect on the health of the eye.

We are now studying a very thin and delicate membrane in the eye which sheathes the tiny blood vessels in the back of the eye and also the eye's crystalline lens. It is called "basement membrane" and there is evidence that it plays a vital role in maintaining the health of the eye. We are hopeful that this study of the basement membrane will lead us to important advances in the prevention and management of blinding eye diseases such as diabetic retinopathy, cataract, retinal degenerations, and retinal detachment.

Because this is very fundamental research into a tissue that is found throughout the body, as well as in the eye, there are exciting possibilities that we will gain insights into diseases that affect other organs such as the kidney. More exciting still is that this delicate tissue may hold some of the secrets of the aging process.

No research carries an automatic guarantee of success. Yet even partial success in any of our programs will have a significant impact on reducing the incidence of visual impairment and, consequently, the burdens that blindness places on our society.



(a) Patient with an eye tumor is prepared for treatment with proton beam from Harvard cyclotron. (b) Spectrographic analysis of basement membrane tissue to chart changes in the eye caused by diabetes. (c) Developing a new diagnostic instrument that will record levels of oxygen carried in the tiny blood vessels nourishing the retina. (d) A neuroscientist prepares instruments to study the pathways between the retina and the visual centers of the brain.

THE WEAPONS OF MODERN RESEARCH: SOPHISTICATED, INDISPENSABLE... AND EXPENSIVE

Many people continue to cherish classic stereotyped misconceptions about certain professional groups, such as: "Artists do their best work starving in a garret." Or, "all a good scientist really needs is a test tube or two, a bunsen burner and a microscope". The fact that scientific achievements of note are produced under adverse conditions should make us wonder all the more what could be done with proper support. Today, the laboratory scientist can no more demonstrate the validity of his theories without modern technology and the support system to maintain it, than could a weekend hiker climb Mt. Everest with knapsack and walking stick.

Scientific research, as it moves deeper and deeper into the unknown, is indeed an extremely expensive enterprise. Medical research dealing as it does with that ultimate complexity of creation – life itself – is unfortunately the most expensive and most undernourished of all our scientific endeavors.

As a practical policy, when the Institute purchases significant new technical apparatus, it does so not in the vague hope that something good will come out of it. Such equipment is acquired in direct response to the forward thrust of the science in place at the Institute and is vital to our continued progress.

But in the final analysis, the most powerful weapon we have in the conquest of blindness is the well trained scientific mind. If we cannot continue to attract enthusiastic, talented, young people into science, if we cannot afford to give them reasonable livelihoods and career encouragement, no amount of gleaming laboratory equipment or engineering marvels will produce anything of scientific merit in the future.

Essential and costly equipment of the Institute's modern laboratories include the electron microscope shown above. Computers, large and small, and super-sensitive electronic equipment make possible investigations that could not otherwise be undertaken.

SHARING THE BENEFITS OF INSTITUTE RESEARCH WITH THE WORLD

The Eye Research Institute is committed to sharing its knowledge with the medical and scientific community and to educating the general public.

Each year, a number of postdoctoral fellowships are offered to young eye surgeons and scientists from all over the world. Candidates of exceptional promise are selected for intensive training in specialized techniques of eye research and management of eye diseases for periods averaging 2 years. There are currently over 250 former fellows of the Institute throughout the United States, and in over 25 foreign countries.

The 900 scientific papers and several books published by Institute staff since 1950 have resulted in greater understanding and more effective treatment of eye disorders. Medical text books written by staff members, rank as definitive works in their specialty.

The Institute conducts mini-courses on new techniques and sponsors major international congresses on important topics in the field of research and eye care. In addition, staff members lecture worldwide.

It is by sharing this knowledge with the scientific community that the scientists avoid unnecessary duplication of effort and expense. In addition, no researcher is willing to devote years of his life in a race for knowledge, when another scientist has an obvious headstart.

The Institute also publishes medical bulletins and the SUNDIAL Newsletter, which bring the latest information on progress in eye research and eye care to members of the general public.

(a) Eye surgeons from throughout the country and abroad attend mini-courses in treatment and diagnosis taught by Institute staff. (b) Opening moments of International Vitreoretinal Congress in Boston. (c) Institute staff artist prepares illustrations for medical textbook.

THE PRICE OF VICTORY OVER BLINDING EYE DISEASE–IT COMES HIGH, BUT IT IS ONLY A TINY FRACTION OF THE COST OF BLINDNESS.

The cost of four days of treatment, care and rehabilitation of the blind in the U.S. is equal to what the Federal Government spends in eye research over an entire year!

There are hopeful signs that the practical as well as the humanitarian aspects of adequate Federal funding of eye research are becoming better understood and accepted by the Congress.

You can do much as an individual to encourage government support of the eye research community throughout the country by merely letting your Senator or Congressman know of your interest.

But, government support alone is not the complete answer. The yearly uncertainties of the legislative and political processes create a climate of anxiety in which forward planning in research is difficult. As a result many opportunities are lost, and many fine scientists turn to other endeavors and many potentially great scientists among our young people seek more stable careers.

The only hope of eliminating this climate of anxiety is to rely on private financial support from generous individuals, corporations and foundations. It is this support that has initiated so much of the sight-saving research done at the Eye Research Institute of Retina Foundation.

Today, the Institute needs such private support more than ever–to create a stable environment in which to plan and conduct research on a cost-effective basis; to initiate promising new research without delay; to encourage and train talented physicians and scientists in the study of eye disease and specialized eye care; and to increase the speed at which research is translated into patient benefits.

With victory in sight for *sight... your dollars are needed for the war chest!*

The Eye Research Institute has been designated as a 501(c)(3) charitable corporation by the Internal Revenue Service. Gifts made to it are deductible in the computation of income tax within the limits permitted by law.

A PRAYER FOR SCOTTY

This beautiful five-year-old is afflicted with a disease that threatens him with total blindness. This fate may befall him when he is ten or fifteen or twenty but sooner or later, as medical science now stands, it is almost certain Scotty will not again see the faces of those whom he loves. He will feel the warmth of the sun but never see it rise or set in glory. He will hear the thunk of a tennis ball on a tight racquet but never see it nick the baseline; hear the song of birds but never see their joyous flight.

Vision is the pearl of the human senses. We pray for the success of those who by willing portfolio have dedicated their lives to its preservation or restoration. We pray for those who with compassionate generosity support their endeavors. We pray for Scotty and for all those who, whether in the morning, midday or evening of their lives, are threatened with the night of blindness. Without hesitation or doubt I ask the God of us all to prosper the work that will assure that their light shall not fail. I think it is a benediction He will readily and gladly bestow.
Amen.

Rev. Michael G. Pierce, S.J.